



# Master of Science Biotechnology

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Biotechnology is a field of science and technology that involves the use of living organisms, cells, and biological systems to develop products and processes for a wide range of applications. At BSSE, we integrate modern methods of studying cells and their behaviour and state-of-the-art bioengineering methods to advance human health and sustainable production.

Biotechnology is one of the crucial engineering sciences of the 21st century. With the advent of “-omics” technologies we have insight into the functions of cells, tissues and organisms at unprecedented detail. With novel methods such as next-generation sequencing, CRISPR/Cas9 genome editing, high-resolution imaging and miniaturization we have unique tools to understand and program cellular and molecular behaviour. In the ETH Biotechnology master’s programme, students are trained to utilise these novel developments for the study and re-programming of cells. At the same time, students are endowed with the knowledge of how to exploit biological systems for applications in health and the pharmaceutical and chemical industry. Next to insights into the most relevant advanced topics of modern biotechnology, students can profit in classes and projects from the close industrial ties and insights into the entrepreneurial aspects of modern biotechnology.

The master’s degree programme in biotechnology provides a scientific education in biotechnology with a focus on systems biology and synthetic biology.

The master’s degree qualifies for advanced development activities in biomedical research and development, the pharmaceutical industry and diagnostics, the chemical industry, related areas such as food and feed industry, and the corresponding sectors of public administration, associations, and consulting.

**Language of instruction**

English

**Credits | duration**

120 ECTS | 2 years

**Academic title**

Master of Science ETH in Biotechnology

**Location**

Basel

The programme takes place at the Department of Biosystems Science and Engineering D-BSSE in Basel

## Curriculum Structure

The master's degree programme in Biotechnology offers intensive training in *the* molecular science and engineering discipline of the 21st century with world-renowned scientists in the heart of the world's pharma capital.

The structure of the programme aims at an optimal trade-off between the breadth of education and specialization with flexibility according to the student's own choices.

The programme is developed around three closely interrelated themes:

It provides **intensive training in biotechnology with a strong research footing in modern topics** ranging from stem cell biology, immunoengineering, bionanotechnology and bioengineering to the various implementations of synthetic biology (cellular reprogramming, mammalian cell biotechnology, metabolic engineering, enzyme technology). Classes and seminars are complemented by intensive practical training in modern laboratory techniques, including genomics, optical analyses, use and engineering of microsystems, microbial biotechnology, and molecular and cellular engineering.

The programme is designed to **integrate the quantitative and model-based approaches that are crucial to modern biotechnology**. Programme participants are invited and encouraged to endorse and exploit a broader, systems-oriented view of the cell, a particular strength of the ETH Department of Biosystems Science and Engineering.

The **integration of core industrial and entrepreneurial elements** into the curriculum provides a strong foundation for future careers in the biotech and pharma industry – or any other field graduates might choose.

The programme is mentor-driven. Students are matched with a mentor advising them in compiling their individual curriculum. The mentoring system aims at providing an excellent, specialized education, while granting sufficient flexibility to meet the expectations and needs of students. The varied course selection and individual study plan provide a flexible study programme.

1 <sup>st</sup> semester	2 <sup>nd</sup> semester	3 <sup>rd</sup> semester	4 <sup>th</sup> semester	ECTS
Core Courses				6
Practical Lab Courses <i>lab courses last September through July</i>				16
Advanced Courses & Electives				36
Science in Perspective				2
Research Project/ Industry Internship <i>completed during or between semesters</i>				16
Master's Thesis				44
TOTAL				120

### Core Courses (22 ECTS)

Cores courses are taught as lectures (6 ECTS) and as practical lab courses (16 ECTS). They provide basic and advanced knowledge in the application of theoretical, engineering, and experimental methods in a biotechnological context.

### Advanced Courses and Electives (36 ECTS)

Advanced courses (min. 22 ECTS) provide specific insights into certain research areas.  
Elective courses (min. 10 ECTS) are chosen flexibly and in agreement with the mentor, providing the opportunity to deepen knowledge in the students' individual interests.

### Science in Perspective (2 ECTS)

Enrichment of students' general education

### Research Project or Industry Internship (16 ECTS)

Flexible project work to familiarise students with scientific working methods and provide in-depth insights into current research topics. Students may complete a project in a research group or an industry internship.

### Master's Thesis (44 ECTS)

A research project of 35 weeks duration, including a written report and an oral presentation.

Flexible course selection and mentor-based studies programme

## Qualification profile

The Master's degree programme in Biotechnology imparts knowledge and skills regarding the experimental analysis and targeted engineering of biological systems and molecules. Graduates of the programme can deploy theories, methods, techniques, and tools from the areas of cell biology, immunology, microbiology, molecular biology, biophysics, microtechnology and technical biochemistry responsibly and professionally.

The Master's degree qualifies its holders to assume advanced development tasks in biomedical research and development, the pharmaceutical and diagnostics industries, the chemical industry, the food and animal feed industries, the biotechnology equipment and plant industries and the corresponding sectors of public administration, non-government associations and consulting.

**Subject-specific knowledge and skills:** graduates possess in-depth knowledge in the areas of systems biology and bioinformatics and their targeted influence on cellular and molecular systems. They have a broad understanding of the computational analysis and fabrication methods deployed and possess specialist knowledge in a selected area of systems biology or biotechnology.

**Analytical skills:** graduates can address and analyse research issues in systems biology and biotechnology and can assess the potential of new developments in these rapidly changing fields.

**Development skills:** graduates can apply experimental and computational methods and models to research issues in systems biology and biotechnology. They are able to analyse system-wide and molecular impacts on the behaviour and performance of biosystems in a goal-oriented manner and develop targeted, efficient procedures for influencing such systems. They can develop mechanical concepts and solutions in the micro- and macro areas for the provision of biotechnology projects and diagnostic procedures.

**Personal and social competences:** graduates master a variety of transferable and social skills. They can clearly formulate concepts, problems, and solutions in written and oral form for experts and lay persons. They are able to compile independent scientific reports and present research results to an interdisciplinary audience in the form of talks and posters. Graduates are further able to collaborate in a goal-oriented manner with specialists from neighbouring disciplines such as chemistry, the health sciences, process engineering and bioinformatics, and they can relate the specialist literature to their own research and reflect critically on it.

**Job perspectives** of graduates from the ETH master's degree programme in Biotechnology are excellent. Typical careers include employment and entrepreneurship in the pharmaceutical and biotechnological industry, including the major global players headquartered in Basel and the strong Swiss start-up sector in the biotechnology field, but also in a broad variety of other sectors ranging from chemistry and chemical engineering via food biotechnology and consulting to insurance and the public sector. About half of the graduates continue to pursue doctoral studies inside and outside of the department.

## Application & Admission

Excellent students holding a bachelor's degree in biology, biomedicine, biotechnology, natural sciences, and other disciplines with a strong theoretical-mathematical background are welcome to apply. A minimum background in biology, mathematics, and computer science is mandatory for all students.

The admission committee may issue additional requirement courses to students whose bachelor's degree curriculum does not fulfil all admission criteria. Additional requirement courses need to be taken in addition to the regular master's degree programme.

Students from non-biology-focused bachelor's degree programmes, such as electrical, mechanical, or chemical engineering, chemistry, or physics, may be admitted with additional requirements of 30 ECTS in biology. In this case, the overall programme duration is extended by 1 semester.

## Further information

MSc Biotechnology programme

[Programme Website](#)

Department of Biosystems Science and Engineering

[D-BSSE Website](#)

Application process and admission prerequisites

[ETH Zurich Admissions Office](#)

Financial aspects & tuition fees

[ETH Financial Aid Office](#)

Studies at ETH

[ETH Student portal](#)

Information for international students

[ETH International Student Office](#)



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